

## CLAIMS

What is claimed is:

1. A method of parallel data rate setting in first and second modem pools, each modem pool including a plurality of modems, where each modem in one of said modem  
 5 pools is paired with a corresponding modem in the other of said modem pools, the method comprising the steps of:
  - a) setting substantially in parallel each of said modem pairs to an initial data rate;
  - for each of said modem pairs:
    - 10 b) performing the following steps c) - d) one or more times until a termination condition is met:
      - c) if said modem pair is synchronized within a synchronization time period, increasing said modem pair's data rate;
      - d) if said modem pair is not synchronized within said  
 15 synchronization time period, decreasing said modem pair's data rate; and
      - e) setting each of said modem pairs to the highest data rate at which said modem pair achieved synchronization.
2. A method according to claim 1 and further comprising establishing a vector  
 20 of initial data rates, wherein each of said data rates corresponds to a different one of said modem pairs, and wherein said setting step a) comprises setting each of said modem pairs to its corresponding initial data rate in said vector.

3. A method according to claim 2 wherein said establishing step comprises establishing said vector at one of said modem pools and communicating said vector to the other of said modem pools.

4. A method according to claim 2 wherein said establishing step comprises establishing said vector from data rates previously used by said modem pairs.

5. A method according to claim 2 wherein said establishing step comprises:  
measuring wire attenuation for any of said modem pairs; and  
interpolating said corresponding data rate from said wire attenuation using  
heuristics.

6. A method according to claim 2 wherein said establishing step comprises:  
measuring SNR for any of said modem pairs; and  
interpolating said corresponding data rate from said SNR using heuristics.

7. A method according to claim 1 wherein said performing step b) comprises incrementing an iteration counter and wherein said termination condition is met when said iteration counter reaches an iteration limit.

8. A method according to claim 1 wherein said performing step b) comprises performing until an elapsed time limit is reached.

9. A method according to claim 1 wherein said performing step b) comprises performing until there is no change in said data rates from a previous iteration of step b).

10. A method according to claim 1 and further comprising adjusting said highest

5 data rate for any of said modem pairs according to the formula

$$Rate_{Corrected} = Rate_{Max} - StabilityFactor * \frac{SNR_{Ref} - SNR}{SNR_{Ref}}$$

where  $Rate_{Max}$  is said highest data rate,  $StabilityFactor$  is any factor for step adjustment, SNR is the measured SNR of said modem pair, and  $SNR_{Ref}$  is any SNR value.

10 11. A method according to claim 10 wherein said adjusting step comprises using the minimum SNR of said modem pair where the SNR differs for each of said modems in said modem pair.

12. A method of parallel data rate setting in first and second modem pools, each  
15 modem pool including a plurality of modems, where each modem in one of said modem pools is paired with a corresponding modem in the other of said modem pools, the method comprising the steps of:

a) establishing a vector of initial data rates, wherein each of said data rates corresponds to a different one of said modem pairs;

20 b) setting substantially in parallel each of said modem pairs to said modem pair's corresponding data rate in said vector;

c) setting a lower rate for each of said modem pairs that is less than or

equal to said modem pair's initial data rate;

d) setting an upper rate for each of said modem pairs that is greater than or equal to said modem pair's initial data rate;

for each of said modem pairs:

5 e) performing the following steps f) - j) one or more times until a termination condition is met:

f) if said modem pair is synchronized within a synchronization time period:

10 g) setting a lower rate for said modem pair equal to the current data rate of said modem pair; and

h) setting a maximum rate for said modem pair equal to the current data rate of said modem pair;

15 i) if said modem pair is not synchronized within said synchronization time period, setting a higher rate for said modem pair equal to the current data rate of said modem pair;

j) setting said modem pair's corresponding data rate in said vector to between said lower rate and said higher rate; and

k) setting each of said modem pairs to said modem pair's maximum rate where said modem pair achieved synchronization at said maximum rate.

20

13. A method according to claim 12 wherein said establishing step comprises establishing said vector at one of said modem pools and communicating said vector to the other of said modem pools.

14. A method according to claim 12 wherein said establishing step comprises establishing said vector from data rates previously used by said modem pairs.

5 15. A method according to claim 12 wherein said establishing step comprises:  
measuring wire attenuation for any of said modem pairs; and  
interpolating said corresponding data rate from said wire attenuation using  
heuristics.

10 16. A method according to claim 12 wherein said establishing step comprises:  
measuring SNR for any of said modem pairs; and  
interpolating said corresponding data rate from said SNR using heuristics.

17. A method according to claim 12 wherein said performing step e) comprises  
15 incrementing an iteration counter and wherein said termination condition is met when  
said iteration counter reaches an iteration limit.

18. A method according to claim 12 wherein said performing step e) comprises  
performing until an elapsed time limit is reached.

20

19. A method according to claim 12 wherein said performing step e) comprises  
performing until there is no change in said data rates from a previous iteration of step e).

20. A method according to claim 12 and further comprising adjusting said highest data rate for any of said modem pairs according to the formula

$$Rate_{Corrected} = Rate_{Max} - StabilityFactor * \frac{SNR_{Ref} - SNR}{SNR_{Ref}}$$

where  $Rate_{Max}$  is said highest data rate,  $StabilityFactor$  is any factor for step adjustment,  
5 SNR is the measured SNR of said modem pair, and  $SNR_{Ref}$  is any SNR value.

21. A data communications system comprising:

a first and a second modem pool, each modem pool including a plurality of modems, where each modem in one of said modem pools is paired with a corresponding  
10 modem in the other of said modem pools; and

a parallel data rate setter operative to:

a) set substantially in parallel each of said modem pairs to an initial data rate;

for each of said modem pairs:

15 b) perform the following steps c) - d) one or more times until a termination condition is met:

c) if said modem pair is synchronized within a synchronization time period, increase said modem pair's data rate;

d) if said modem pair is not synchronized within said  
20 synchronization time period, decrease said modem pair's data rate; and

e) set each of said modem pairs to the highest data rate at which said modem pair achieved synchronization.

22. A system according to claim 21 wherein said parallel data rate setter is additionally operative to establish a vector of initial data rates, wherein each of said data rates corresponds to a different one of said modem pairs, and set each of said modem pairs to its corresponding initial data rate in said vector.

5

23. A system according to claim 22 wherein said parallel data rate setter is additionally operative to establish said vector at one of said modem pools and communicate said vector to the other of said modem pools.

10 24. A system according to claim 22 wherein said parallel data rate setter is additionally operative to establish said vector from data rates previously used by said modem pairs.

15 25. A system according to claim 22 wherein said parallel data rate setter is additionally operative to:

measure wire attenuation for any of said modem pairs; and

interpolate said corresponding data rate from said wire attenuation using heuristics.

20 26. A system according to claim 22 wherein said parallel data rate setter is additionally operative to:

measure SNR for any of said modem pairs; and

interpolate said corresponding data rate from said SNR using heuristics.

27. A system according to claim 21 wherein said parallel data rate setter is additionally operative to increment an iteration counter and wherein said termination condition is met when said iteration counter reaches an iteration limit.

5

28. A system according to claim 21 wherein said parallel data rate setter is additionally operative to perform step b) until an elapsed time limit is reached.

29. A system according to claim 21 wherein said parallel data rate setter is additionally operative to perform step b) until there is no change in said data rates from a previous iteration of step b).

30. A system according to claim 21 wherein said parallel data rate setter is additionally operative to adjust said highest data rate for any of said modem pairs according to the formula

$$Rate_{Corrected} = Rate_{Max} - StabilityFactor * \frac{SNR_{Ref} - SNR}{SNR_{Ref}}$$

where  $Rate_{Max}$  is said highest data rate,  $StabilityFactor$  is any factor for step adjustment, SNR is the measured SNR of said modem pair, and  $SNR_{Ref}$  is any SNR value.

31. A system according to claim 30 wherein said parallel data rate setter is additionally operative to adjust using the minimum SNR of said modem pair where the SNR differs for each of said modems in said modem pair.



32. A data communications system comprising:

a first and a second modem pool, each modem pool including a plurality of modems, where each modem in one of said modem pools is paired with a corresponding  
5 modem in the other of said modem pools; and

a parallel data rate setter operative to:

a) establish a vector of initial data rates, wherein each of said data rates corresponds to a different one of said modem pairs;

b) set substantially in parallel each of said modem pairs to said modem  
10 pair's corresponding data rate in said vector;

c) set a lower rate for each of said modem pairs that is less than or equal to said modem pair's initial data rate;

d) set an upper rate for each of said modem pairs that is greater than or equal to said modem pair's initial data rate;

15 for each of said modem pairs:

e) perform the following steps f) - j) one or more times until a termination condition is met:

f) if said modem pair is synchronized within a synchronization time period:

20 g) set a lower rate for said modem pair equal to the current data rate of said modem pair; and

h) set a maximum rate for said modem pair equal to the current data rate of said modem pair;

i) if said modem pair is not synchronized within said synchronization time period, set a higher rate for said modem pair equal to the current data rate of said modem pair;

j) set said modem pair's corresponding data rate in said vector  
5 to between said lower rate and said higher rate; and

k) set each of said modem pairs to said modem pair's maximum rate where said modem pair achieved synchronization at said maximum rate.

33. A system according to claim 32 wherein said parallel data rate setter is  
10 additionally operative to establish said vector at one of said modem pools and communicate said vector to the other of said modem pools.

34. A system according to claim 32 wherein said parallel data rate setter is  
15 additionally operative to establish said vector from data rates previously used by said modem pairs.

35. A system according to claim 32 wherein said parallel data rate setter is additionally operative to:

measure wire attenuation for any of said modem pairs; and  
20 interpolate said corresponding data rate from said wire attenuation using heuristics.

36. A system according to claim 32 wherein said parallel data rate setter is

additionally operative to:

measure SNR for any of said modem pairs; and

interpolate said corresponding data rate from said SNR using heuristics.

- 5 37. A system according to claim 32 wherein said parallel data rate setter is additionally operative to increment an iteration counter and wherein said termination condition is met when said iteration counter reaches an iteration limit.

38. A system according to claim 32 wherein said parallel data rate setter is  
10 additionally operative to perform step e) until an elapsed time limit is reached.

39. A system according to claim 32 wherein said parallel data rate setter is  
additionally operative to perform step e) until there is no change in said data rates from a  
previous iteration of step e).

- 15 40. A system according to claim 32 wherein said parallel data rate setter is additionally operative to adjust said highest data rate for any of said modem pairs according to the formula

$$Rate_{Corrected} = Rate_{Max} - StabilityFactor * \frac{SNR_{Ref} - SNR}{SNR_{Ref}}$$

- 20 where  $Rate_{Max}$  is said highest data rate,  $StabilityFactor$  is any factor for step adjustment, SNR is the measured SNR of said modem pair, and  $SNR_{Ref}$  is any SNR value.